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Assessing the Complementarity of Common Transport Policy Objectives; A Scenario Approach'

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[1] The paper is based on the Possum (Policy Scenarios for sustainable mobility) project, which represents Strategic Research Task 13 in the 4th Framework Transport Programme of the European Union. Other members of the Possum group are: Maria Giaoutzi and Zenia Dimitrakopoulou (NTUA, Athens); Christian Hey and Ruggero Schleicher-Tappeser (EURES, Freiburg); Sven Hunhammar and Peter Steen (ESRG/FOA, Stockholm); Veli Himanen (VTT, Espoo); Wolclech Suchorzewski (WUT, Warsaw) and Viacheslav Arsenov (MTI, Moscow).

Abstract

This paper examines the extent to which the main objectives of the European Common Transport Policy (CTP) are complementary. A total of six scenarios are constructed, reflecting three different policy objectives and two futures of Europe. The three policy objectives considered are economic efficiency, regional development and environmental protection. The two assumptions about the future of the EU (called external frameworks) are 'Cooperation ' - which assumes greater harmonisation of European policies and actions, expansion of the EU and a high social acceptance of policy measures - and 'Polarisation ', which presents more or less opposite developments. The outcomes of each scenario are examined using a selection of indicators to represent the main impacts. It is concluded that there is to some extent complementarity between environmental and efficiency objectives, while there is little complementarity with regional development objectives.

1 The Common Transport Policy of the European Union

The objectives and outcomes of transport policy are multifaceted, and include issues such as equity, environment, regional development and economic growth. Consequently, transport policy is shaped by many stakeholders in a complex policy-making environment (Rienstra and Nijkamp, 1997). Scenarios may provide insights in the trade-offs to be made in transport policies, as well as the impacts of these policies on other fields (Masser et al., 1992). In this paper we will apply such an approach to the Common Transport Policy (CTP) of the European Union (EU), which has seven main objectives (CEC, 1992):

* the continued reinforcement and proper functioning of the internal market facilitating the free movement of goods and persons throughout the Community;
* the transition from the elimination of the artificial regulatory obstacles towards the adoption of the right balance of policies favouring the development of coherent, integrated transport systems for the Community as a whole using the best available technology;
* the strengthening of economic and social cohesion by the contribution which the development of transport infrastructure can make to reducing disparities between the regions and linking island, land-locked and peripheral regions with the central regions of the Community;
* measures to ensure that the development of transport systems contributes to a sustainable pattern of development by respecting the environment and, in particular, by contributing to the solution of major environmental problems such as the limitation of CO_2;
* actions to promote safety;
* measures in the social field;
* the development of appropriate relations with third countries, where necessary giving priority to those for which the transport of goods or persons is important for the Community as a whole.

Over recent years, expenditure under the CTP has increased, due to a number of factors, such as to compensate peripheral regions for economic disadvantages of the European Monetary Union criteria (Banister, 1995; Banister and Berechman, 1993; Hey, 1996). The CTP aims to close the gaps in European transnational networks for both road and rail infrastructure (Nijkamp et al., 1994), in order to generate economic growth and to stimulate regional economic development. The European Commission has officially stated that each transport mode should cover its full social and environmental costs (CEC, 1996), although the implementation of these proposals is being hampered by expected negative economic impacts and the low political and social feasibility of measures.

European regulation aims at reducing air pollution by road vehicles by setting emission reduction targets per vehicle, by reducing traffic congestion and reducing mobility growth. The first has been relatively successfully applied over recent decades in Europe, which reduced emissions of several gases up to 50% (OECD, 1993). However, the reduction of CO_2 emissions is still seen as a major

environmental challenge. There is an official EU target (set at the 1992 Rio Summit) of reducing CO_2 emissions to 1990 levels by 2000. All EU-members, with the exception of Ireland and Spain, have made the EU target an official policy goal, while several countries (e.g., the Netherlands and Sweden) have set more ambitious goals (Stead, 1997).

This paper assesses the complementarity of the above mentioned policy objectives and begins to map out the research methodology. The indicators for assessing the main effects of alternative policy packages are then presented. Next, three alternative sets of policies are described and the main impacts of these policies are summarised by means of the indicators, with the year 2020 being taken as the target for policy achievement; the process allows assessment of the extent to which the alternative sets of policies are complementary. In the final section, policy recommendations for the EU are given.

2 Methodological Framework

The above discussed policy objectives are rather abstract and broad. In order to keep the analysis manageable we therefore redefined the CTP-objectives in three issues:

* *efficiency*: subsidies should be minimized and market principles should prevail in the operation of the transport system and in investment assessments;
* *regional development* : transport should stimulate economic development in peripheral regions and at the same time stimulate social cohesion within Europe;
* *environment:* the transport sector should reduce its external (environmental) impacts.

Regional development will likely stimulate social cohesion and the position of socially weak groups to some extent also. Therefore, social cohesion objectives - including safety - are brought partly into the regional development objective and partly in the external frameworks to be discussed later. Another choice would be to include this in the environmental part, so that social and environmental costs should be reduced at the same time.

When shaping transport policies, spatial, socio-economic, institutional, cultural, psychological, technical and demographic factors all play an important role in the future of transport policy outcomes (Nijkamp et al., 1997). In this respect also the opposite holds: transport policies influence policies in these fields. It is clear, however, that not all factors can be included in the scenarios, since this would make the analysis too complex and wide-ranging.

Two types of factors are therefore considered in scenario construction: internal and external factors. The process of identifying internal and external factors is presented diagrammatically in Figure 1.

The *internal* factors - those which can be influenced by transport policy - were determined by literature review and opinion surveys of transport experts from Europe. For the purposes of this research, the *external* factors - those which tran-

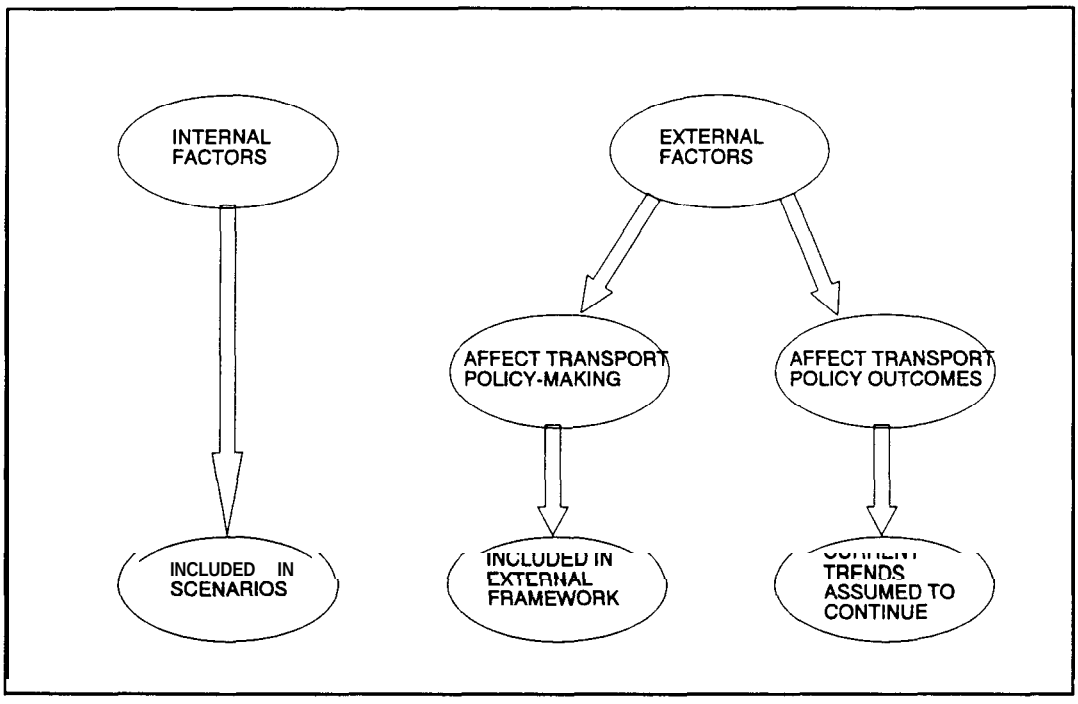

Figure 1 The role of internal and external factors in scenario construction

sport policy cannot directly affect but which have an effect on transport policy outcomes - were divided into two types according to whether they are likely to significantly effect policy-making and policy implementation at the European level. Again, these factors are selected by literature review and opinion surveys of transport experts from Europe.

The external factors identified will likely have a significant effect on policy making and policy implementation at the European level, are included in two so-called external frameworks, which include opposing futures for policy-making at the European level:

* *Cooperation* is characterised by greater harmonisation of European policies and actions, an expansion of the EU towards central-eastern (CEC) countries and a high acceptance of policy measures at the social level.
* *Polarisation:* is characterised by resistance to European policies and actions, while there is little or no expansion of the EU.

It is likely that these opposite developments may have a large impact on the future of the transport system; whether this is actually the case is one of the aims of the scenario assessment (see Table 1). It should be acknowledged that these frameworks do not include any value statements; they are meant only as descriptions of possible futures of the EU.

The second type of external factors - those which may have a significant effect on transport policy outcomes but unlikely to have a significant effect on policy making and policy implementation at the European level - are not included in the external frameworks. Trends in these factors are assumed to continue and

Table 1 Features of the polarisation and cooperation external frameworks

Polarisation	**Cooperation**
Institutional/economic * EU integration is halted: no new members, no EMU * Little European coordination of transport and environmental policies * Little cooperation in research and development * Low economic growth	*Institutional/economic* * EU integrates further: more members, EMU * Strong coordination of European transport and environmental policies * European coordination of research and development * High economic growth
Social * Little support for transport and environmental policy measures * Equity is not an important policy objective	*Social* * Wide support for transport and environmental measures * Social cohesion/equity is an important policy issue

not to change substantially up to the year 2020. These factors will not be discussed in order to reduce the complexity of our analysis.

In order to identify the extent to which the main objectives of the CTP are complementary, two models of the relationship between these objectives are examined. The conventional (two-dimensional) model of the relationship between the three objectives - efficiency, regional development and environment - is shown in Figure 2a, in which each of the three objectives appear in tension.

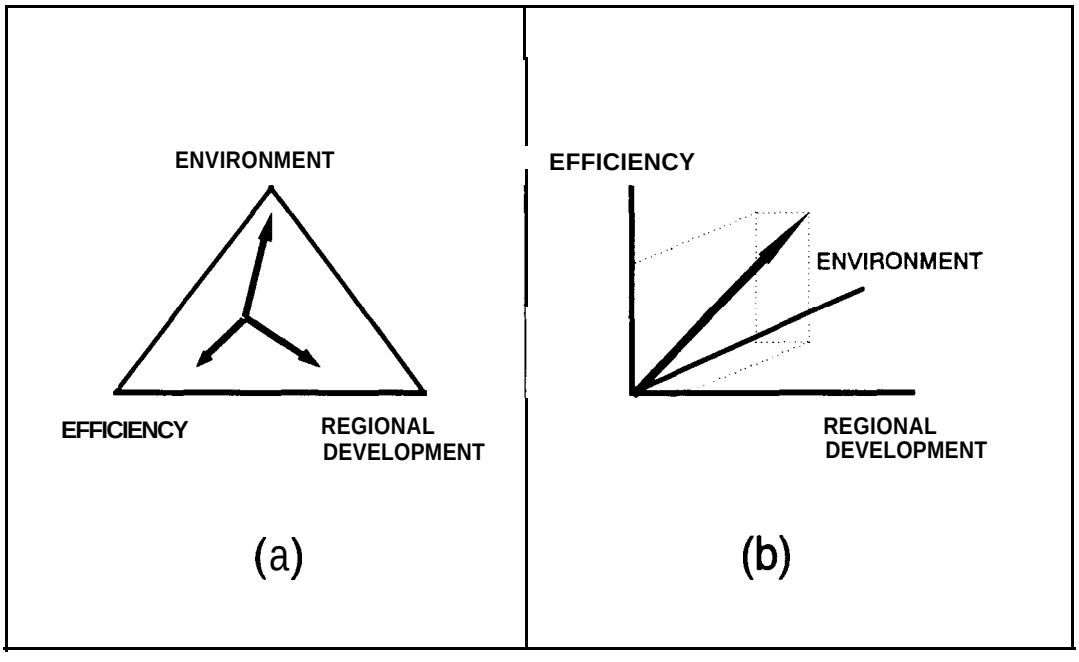

Figure 2 Models of the relationship between economic efficiency, regional development and environmental protection

This model implies that each objective can only be achieved at the expense of the two other objectives. However, it may be that one objective can be achieved without negative effects on other objectives. Indeed, it may be the case that the achievement of one objective is complementary to the achievement of one or both of the other objectives (resulting in win-win or win-win-win situations). The relationship between the three objectives may be closer to the three-dimensional model shown in Figure 2b. Our analysis seeks to examine how the outcomes of the alternative policy scenarios fit within these two models. For a more detailed discussion of the methodology and the external frameworks we refer to POSSUM (1997) [2].

Scenarios can now be constructed, which describe the optimization of policies regarding these policy objectives within both frameworks, resulting in six distinct scenarios. In this way it is possible to test both the impacts of external developments and of a policy focus on one of the three main issues. Before constructing these scenarios, it is however first necessary to identify indicators for each of the three policy dimensions, in order to identify which issues may be optimized and to assess the scenarios in a later section. These indicators will be identified now.

3 Indicators for CTP-objectives

The indicators chosen should represent the range of impacts of transport policies. More specifically, indicators assist in the following functions:

* to *identify* how policy scenarios perform across a range of impacts (within the three areas of economic efficiency, regional development and environmental protection);
* to *compare* the outcomes of similar policies under different external conditions (i.e. different exogenous factors);
* to assess whether more than one group of policy objectives can be achieved for each policy scenario (i.e., assessing the complementarity of different policy objectives).

The construction of indicators is based on a synthesis of three approaches (Figure 3). The first approach involves the identification of the main CTP objectives from EU policy statements (CEC, 1992; CEC, 1993). In the second approach all the major impacts of transport policy are identified, by means of literature review and expert group opinion surveys. The third approach finally, uses a review of existing indicators of transport policy from other studies. These three approaches provide a basis for identifying, validating and checking the indicators.

[2] The POSSUM deliverable 1 can be obtained by contacting Prof. dr. David Banister, UCL Bartlett School of Planning, 22 Gordon Street, London WC1H OQB, UK; email: d.banister-@ucl.ac.uk.

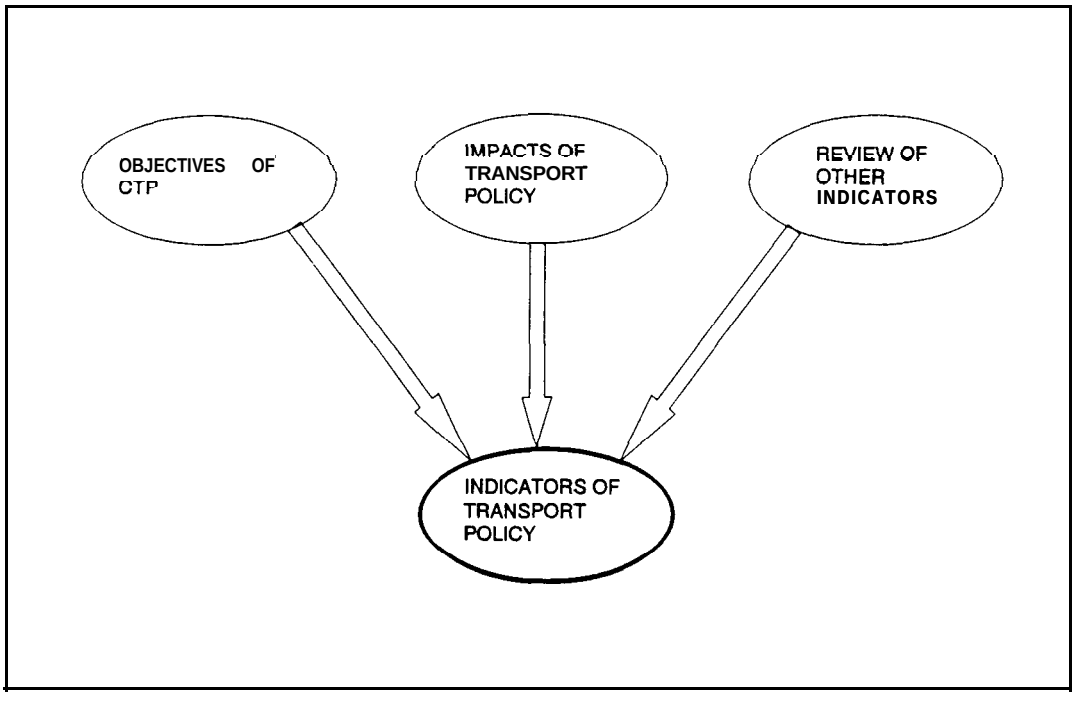

Figure 3 Three convergent approaches for developing indicators of transport policy

The main impacts of European transport policy on efficiency, regional development and environment are identified by literature review and opinion surveys of European transport experts (POSSUM, 1997). Existing indicators of the impact of transport policy are also reviewed from international literature sources, which reveals most information on environmental indicators and least information on indicators of regional development. Other indicators discussed but not yet applied are the construction of a Gini coefficient for the internal and external accessibility of (peripheral) regions, and a reduction of total energy use by the transport system.

Table 2 summarises the main impacts and indicators of CTP identified by the three approaches described above. The list of potential indicators illustrate the range of possible indicators which could be used to represent one or more of the main impacts. The most desirable indicators are those which would be most useful if data existed. The most practical indicators are those which are desirable and for which data exists.

Some of the indicators may impact each other; e.g., both NO_x and CO_x emissions are emitted because of fuel use, the number of vehicle kilometres and congestion may also be related to some extent. The distinction between the latter is however highly relevant, because it is an important policy question to which extent mobility growth should be accommodated by infrastructure construction or a modal shift. In the scenarios, a growth in vehicle kilometres might therefore be combined with a reduction in congestion.

As a result of the analysis, a total of eight indicators have been chosen for assessing the effects of transport policy on economic efficiency, regional develop-

Table 2 Desirable and practical indicators for CTP-objectives

Object.'	Issues	Indicators: Potential indicators	Desir.	Pract .
EP CTP4	Climate change Global air pollution Non-renew. res. depletion Building corrosion	CO_2 emissions Non-renewable fuel consumption	* *	Ind. 1
EP CTP4	Acidification Local air pollution Water pollution Human health hazards Ecological degradation	NO_x emissions Persons with transport-related illnesses Emissions of VOCs Particulate emissions	* *	Ind. 2
EP CTP4	Biodiversity loss Land loss/fragmentation	Land loss Species loss Loss of environmental sensitive areas	* * *	Not Used
EP CTP4,5	Safety	Number of persons killed Number of persons injured	* *	Ind. 4
EE CTP1 ,2	Efficient allocation of resources	Infrastructure expenditure (% GNP) % tax revenue from transport Ratio capital/current expenditures	* *[2]	Ind. 7
EE CTP1,2,7	Investment in transport infrastructure	Public/private expenditure per pass. -km Public/private expenditure per tonne-km Ratio road/non-road expenditure	* *	Ind. 6 *
RD CTP3,6	Regional economic development	Regional gini coefficient Ratio incomes central/peripheral regions Network density per capita	*	Ind. 5 *
EE CTP1 ,2	Increases in motorised transport	Total vehicle-km Car ownership per capita Average (motorised) journey length Average fuel consumption per pass.-km	* *	Ind. 3
EE CTP1,2	Congestion	Total time lost through congestion % of network congested Ratio of pass.-km: length of infrastructure Ratio of tonne-km: length of infrastructure	*	Ind. 8

otes: 1 EE Economic Efficiency; RI Regional Development; EP Environmental Protection; C
l-7 refer to then 7 CTP-objectives discussed in Section 1.

2 A more desirable indicator would be spending on infrastructure as a proportion of adjusted GNP such as index of sustainable economic welfare (ISEW). Concepts of national economic performance such as GNP are not necessarily sustainable measures, since a variety of social and environmental factors are not generally included in these measures (Jackson and Marks, 1994).

ment and environmental protection. As discussed before, safety is a social issue which is in our analysis is regarded as part of the regional development dimension. Each indicator represents one or more key impacts of transport policy. The indicators are used in the following section to examine the effects of the different policy scenarios, and assess the complementarity of CTP objectives.

4 Scenarios to Assess the CTP Objectives

Now we turn to the actual scenario construction; a summary of the scenarios is presented in Table 3. The likely impact of each scenario on a range of endogenous factors are first described and then examined more quantitatively by means of the eight indicators developed above. Indicator scores for each scenario are presented in Section 5.

Table 3 Summary of the scenarios

Competitive nations Economic efficiency - Polarisation * Privatisation * Moderate pricing in all forms * Investments based on economic return * Growth mainly in European core zone * Public transport subsidy reduced * Public transport systems reduced * More energy efficient cars * Limited HST-network * Low mobility growth	*Competitive Europe* Economic efficiency - Cooperation * Large scale privatisation * Road and other pricing introduced very much * Investments based on maximum return * Stimulation for peripheral regions * Little new technologies * Some closure of public transport * Limited HST-development * Low mobility growth
Equitable Nations Regional development-Polarisation * Some privatisation * No road pricing or fuel price increases * Little new transport infrastructure * Core zone declines, periphery high growth rates based on own strength * Public transport declines * Little technical development * Low mobility growth	*Equitable Europe* Regional development - Cooperation * No privatisation * No pricing measures * High growth in periphery initiated by European funds * Telecommunications important * HST and airport investments * Little new technologies * Reduced public transport use * High mobility growth
Environmental Nations Environment - Polarisation * No privatisation * Limited road and other pricing * Core dominant and dense development * HST-network completed * Public transport expanded * Large scale investments in new fuels * Low mobility growth	*Environmental Europe* Environment - Cooperation * No privatisation * Much road and other pricing * Large scale investments in public transport * Car use restricted * Core zone dominant * Maglev and new fuels introduced * Public transport dominant * Very low mobility growth

4.1 Competitive Nations (efficiency scenario in a polarised Europe)

Economic principles will be introduced to make an efficient use of the infrastructure and to achieve a modal split which serves to make the system economically optimal. Therefore, private sector involvement in the system will largely be increased, road pricing will be introduced, and railways and other public transport companies will be privatized. Mainly recreational and commuter transport are taxed, because this has the least impact on a country's competitive position.

Congestion will be considered to hamper economic growth and will receive priority in transport policies. Road pricing and measures to increase the capacity of infrastructure will be introduced. As a result, most infrastructure will be constructed in the economic core regions and in and to the economically rapidly growing CEC countries. For air transport a similar policy will be followed.

Spatial trends and regional development

In this scenario, the economy will not be flourishing and national countries tend to concentrate on protection, resulting in spatial inertia. The economy of the European core zone will expand, while economic growth in peripheral regions is low. The spatial organization will largely be left to the market, resulting in a shift of higher income classes out of cities resulting in a decline of city centres and older living quarters.

The accessibility of cities will worsen. Public transport systems will largely be reduced on economic grounds. As a result, congestion in cities will increase, despite the introduction of pricing measures. New and dynamic activities will be located at the city borders, within easy reach of higher income classes; these can be reached by means of private cars and perhaps light rail systems.

The modal split

The efficiency of the transport system requires that the use of materials and fuels will be minimal. As a result, most Research and Development (R & D) will focus on making the private car - which remains in this scenario the dominant transport mode - more energy efficient. The High Speed Train will be introduced all over Europe in order to improve the competitive position of countries. Other new transport modes will appear in general not to be competitive, while also R & D will be very expensive because of the lack of cooperation within Europe.

The profitability of the public transport system will generally be low also because the spatial policy and the population density will have negative drawbacks. For long distance traffic, the operation of railways will be privatized. As a result, many services will be offered at distinct prices, speeds and comfort levels.

4.2 Equitable Nations (regional development in a polarised Europe)

In the scenario 'Equitable Nations', individual countries will tend to protect their own industries. This will especially hold for the core zone, where inefficient industries will be protected. New services-oriented activities will become more footloose, especially because of new developments in the telecommunication sector. Southern and CEC regions will largely benefit from these developments.

Consequently, little new road and rail infrastructure will be constructed in north-western Europe, because there are little funds available here. In southern and CEC countries infrastructure construction will be limited, because better investment possibilities will be available (especially in telecommunication). Therefore congestion increases everywhere. Air transport will become more important at the same time because of the spatial spread of economic activities.

Spatial trends and regional developments

Industrial activities will decline in the densely-populated core-zone because of congestion and relatively bad living conditions. These will be better in southern regions (climate, space, nature), while production costs (housing, labour costs) will be low in CEC countries.

Because of individualistic trends especially the higher educated population will become more footloose and will prefer to live in southern and CEC regions. As a result, big cities in the core zone will detoriate. Cities outside this zone will be rapidly expanding, but their spatial developments will be largely left to the market in order to achieve the highest growth possible.

The modal split

Little attention will be paid to the introduction of new transport technologies and transport infrastructure. Governments in the core zone will focus on the economic situation and the rest of Europe will focus on R & D in telecommunication. Public transport will decline, because of the little funds available, also because the system transport is not thought to help stimulating economic growth.

Road pricing and high fuel taxes will not be introduced, because of its negative impact on economic activities. As a result, the private car will still dominate the transport scene and the potential for a modal shift will be low. Long distance transport will mainly be provided by air transport, which will especially be expanded outside north-western Europe.

4.3 Environmental Nations (environmental scenario in a polarised Europe)

Environmental issues and the national competitive position will both become a main concern and international cooperation will only take place where 'win-win' situations occur. National governments will stimulate new relatively environmental benign economic sectors and activities. Much effort will also be put into technological options for reducing external impacts, while voluntary convenants with economic sectors will become a common way to influence polluting sectors. Road pricing and other price measures will not be introduced to a large extent, because of the low social support.

The growth of air transport will be limited because of the construction of subsidized HST tracks all over Europe. In order to save the environment and to overcome resistance in society, the HST is mainly using upgraded tracks of the current train system.

Spatial trends and regional development

Governments will aim at a compact spatial organization, especially around public transport terminals in the big cities. As a result, large scale economic renewal and economic growth will occur in urban areas. Transport distances are reduced and transport flows are bundled in this way, increasing the competitive position of public transport modes. The spatial-economic differences between regions in Europe will not change much. The core zone will remain the dominant economic centre and peripheral countries will not largely benefit from European regional development funds.

The modal split

Governments will stimulate technological innovations in order to make the current car and aeroplane system more environmentally friendly, e.g, by developing new fuels. Electric cars have largely been improved and fuel cells, liquid hydrogen and methanol will be introduced too. Therefore, no large changes in the behaviour of people and the transport system will be necessary, although large scale subsidies will be needed. Liquid hydrogen will also be introduced in the aviation system.

Railway and urban/regional public transport infrastructure will be largely extended, especially within north-western Europe which has a dense population making the system more profitable. Cars will be the dominant transport mode, while also aeroplane traffic will largely increase. Nevertheless, public transport will largely expand, especially in densely populated areas and larger cities. The system will largely be subsidized in order to attract new customers.

4.4 Competitive Europe (efficiency scenario in a cooperative Europe)

Market principles will be introduced everywhere. A main policy will be the introduction of road pricing (even on secondary roads); the operation will be handed over to private companies. At the same time, the current car and aeroplane system will become very energy efficient by stimulating R & D, raising fuel costs and setting standards.

The private sector will make proposals for infrastructure projects, although also governments will still finance part of infrastructure construction; in southern and CEC countries EU funds will also be available for this purpose. The investments will be paid back by means of the road pricing incomes; in unprofitable cases the government or EU will subsidize infrastructure by means of fixed percentages.

Also public transport companies will be privatized, resulting in an increase in profitability and the service of the companies. Air transport will be levied to the same extent as car transport and privatized as well; flights will be concentrated at some major airports. Eventually, private HST services will operate to cities within reasonable range.

Spatial trends and regional development

It will be a main policy to relocate economic activities to southern and CEC countries. This will especially hold for space extensive activities, the core zone

will specialize on high value added production. The governments will try to stimulate this by means of regional development funds, which will be allocated in a market-based way. Southern and CEC countries will develop economically very positive. As a result, the population and activities will tend to spread out over Europe. Transport flows will also shift, making investments in infrastructure outside north-western Europe necessary.

Big cities will tend to develop positively: their accessibility will improve because of an upgraded rail network and the social segmentation in cities will diminish, also because of the good employment situation. In urban transport, road pricing and parking policies will be introduced, resulting in lower congestion levels. At the same time, many unprofitable public services will be shut down, this especially holds for inefficient tram and bus lines. High quality metro and light rail systems will largely expand. The stations of this system will mostly be reached by bicycles or an efficient system of shared taxis.

The modal split

The technical policy will mainly be oriented on improving current modes and the introduction of the HST on existing tracks, which may be profitable because of higher air ticket prices. On longer distances HST and intercity trains will operate, offering a high quality and efficient service. These will become more competitive because of the price measures in car and aeroplane transport. On short distances on the other hand, public transport will diminish, while the use of shared taxis and bicycles will largely increase. Private cars will serve most mobility demand, despite the introduction of road pricing.

4.5 Equitable Europe (regional development in a cooperative Europe)

Policies will aim to equalise economic activities, welfare and population over Europe, which will largely be achieved by expanding EU cohesion and regional development funds. Peripheral regions will become as a result much more dynamic and will specialize on the production of services; physical distances will become less important due to improved telecommunication technologies.

Transport will be seen as a means to stimulate regional development. The long distance transport system will largely be improved by constructing new road transport infrastructure, financed by EU funds; public transport infrastructure will get no priority. The only exceptions are HST connections, which will be constructed to the main conurbations in Europe. Airports will largely expand in the booming regions, and air transport will not be restricted by the transport policy.

Spatial trends and regional developments

Southern Europe will house an increasing number of elderly, because of the attractive climate, resulting in a high economic growth. Also tourism will become more important for the economy of these regions. CEC countries will mainly concentrate on industrial activities, because of relatively low labour costs and EU subsidies.

The core zone will increasingly specialize on services with a high value added and the distribution sector. However, activities and labour will largely be taxed here (in order to finance EU funds), stimulating a shift out of these regions. Only little infrastructure will be constructed here, because of the decreasing population and low economic growth.

The population and economic activities in southern and central Europe will increase, resulting in large expansions of the cities. Spatial planning will be limited, in order not to hamper economic developments. The population, for example, will prefer to live in 'green' suburbs and will largely travel by private car. The urban transport system will largely be neglected, because this system will not stimulate regional economic growth to a large extent.

The modal split

New technologies in transport will not impact regional development objectives; therefore, little attention will be paid to technical innovations. Most R & D funds will be allocated to telecommunications, which will improve the economic position of southern and CEC countries.

The more diffuse spatial organisation in Europe will negatively impact a modal shift. The booming regions will not have a clear and strict spatial policy either, and the transport system here will largely be based on the conventional private car. Only in long distance transport, the HST will gain some market share, which will be the result of restrictions on air transport. However, most transport will be served by aeroplanes.

4.6 Environmental Europe (environmental scenario in a cooperative Europe)

Transport policies at all levels will stimulate environmental friendly public transport and other modes, while the use of conventional cars will be reduced. Large scale investments in public transport infrastructure will be carried out, largely financed by EU funds. High Speed Trains and Maglev (Transrapid) trains will operate on long distances. Next, high quality intercity trains will provide a more dense coverage, followed by regional train, metro and light rail services. Conventional fuels will be taxed heavily by means of road pricing systems and sales taxes, improving the competitiveness of public transport. Air transport will be heavily regulated and taxed in the same way; flights will only be allowed at connections where no HST/Maglev link is in operation.

Spatial trends and regional development

Spatial policy will become very important for achieving the desired modal shift. New residential and business areas will be planned around the main nodes of the public transport system; in this way urban areas will become very spatially compact. Regions will become less economically specialized because of the high mobility costs. As a result, economic growth in Europe will be rather low. Economic activities will concentrate in north-western Europe, because here the best (public) transport system will be available. In other regions, economic activities will tend to concentrate in the bigger cities, because of the limited

accessibility elsewhere.

City centres will revitalize everywhere, because of the good accessibility by public transport and compact city policies. Metro and light rail systems will largely expand, offering a high quality service. Electric cars and bicycles will often be feeders for the public transport system, while also (shared) taxis, rental possibilities, etc. will be introduced.

The modal split

Most new technical developments will be found in the car and aviation system. Electric cars will largely improve, the same holds for fuel cell cars. Also new aeroplanes will be introduced, fuelled by liquid hydrogen. These developments will be stimulated by taxing conventional fuels heavily and by providing R & D funds by the EU. In addition, subterranean construction will become much cheaper and common.

The public transport system will largely be extended and improved, while car use will heavily be restricted. Also at the urban level, the modal share of the public transport system will largely increase.

Now it is interesting to investigate how the six scenarios score on the distinct indicators identified in Section 3. This will be discussed now.

5 Indicator Scores for Each Scenario

Indicator scores for each scenario are presented in Table 4. Only indicative scores are given, in which '0' represents no major change from the present situation, ' +' and ' + +' represent positive changes, and '-' and '--' represent negative changes. For government expenditure on infrastructure, '-' and '--' represent reductions in expenditure.

Table 4 Assessment of policy scenarios using indicators of economic efficiency, renional development and environmental protection

Scenario	Indicators							
	Environment			Regional		Efficiency		
	CO_2	NO_x	veh-km	saf.	gini	subs.	infra	cong.
Competitive Nations	0	+	+	0	--	+ +		+ +
Equitable Nations	0	0	0	0	+ +	+		
Environmental Nations	+ +	+ +	0	0	0	--	+	0
Competitive Europe	+	+	+	0	0	+ +		+ +
Equitable Europe	--	--	--	0	+ +	--	+ +	--
Environmental Europe	+ +	+ +	+	0	-	0	+ +	+ +

In Competitive Nations, reduced mobility growth and more energy efficient vehicles will have a positive effect on reducing CO_2 and NO_x emissions. Government expenditure on transport will fall. Transport subsidies will be lower because of the emphasis on privatisation and liberalisation. The same holds for investments in infrastructure. Regional disparities will increase, but no clear impact is to be expected in the safety field. Total vehicle kilometres will be reduced to some extent, because of road pricing measures combined with low economic growth (assumed for all scenarios in the polarisation framework). These factors will help to reduce congestion.

The *Equitable Nations* scenario will have no great impact on emissions. Mobility growth will remain more or less unchanged and a modal shift or a large scale introduction new of technologies are unlikely. Government expenditure on transport subsidies and infrastructure will decrease and will be directed at particular locations or population groups. Total vehicle kilometres will not change significantly because of higher growth in peripheral regions, counteracting any reductions in the core zone. Due to the positive economic development, regional development objectives will be achieved. However, a policy focusing on regional development will have little impact on the more socially defined safety indicator, clearly additional policies are necessary for this policy target.

In *Environmental Nations,* alternative fuels will be important and result in significant reductions in CO_2 and NO_x emissions. This will require large subsidies, giving a low score on this indicator. Investment in public transport infrastructure will be high in order to achieve a significant modal shift. The scenario will not have very positive or negative effects on safety and regional development objectives. Mobility levels will remain more or less unchanged, because emission reductions can be achieved through technological developments.

Emissions of CO_2 and NO_x are likely to fall in *Competitive Europe,* as a result of road pricing measures. Because of the privatisation of transport operations and the introduction of road pricing, government expenditure on transport subsidies will be reduced. Similar reductions will take place for expenditure on transport infrastructure, although some investments in infrastructure in peripheral regions will still be approved. Regional development objectives are not achieved in this scenario, the relative economic position is not likely to change. Transport demand will be reduced because of the pricing mechanisms and the spatial concentration which has taken place. As a result of these measures, congestion will also be reduced,

Equitable Europe will result in increased travel distances, mainly due to higher long distance travel. This growth will be fuelled by the construction of Trans-European Networks. This will result in economic growth in peripheral regions. Environmental and economic objectives will not be achieved: emissions of CO_2 and NO_x will grow, and congestion in most areas will increase, while investments will be unprofitable and subsidies will increase in order to finance regional development funds. Again no clear impact can be expected on safety issues.

Finally, in *Environmental Europe,* a modal shift achieved by transport policy will have some positive impacts on reducing CO, and NO_x emissions, but requires large government expenditure for subsidies and infrastructure. These

will be paid by road pricing revenues, so that overall government expenditure for transport provision does not increase. Total transport demand will decrease to some extent due to reduced car use, and this in turn will have positive impacts on congestion levels. Negative impacts on the regional development of peripheral regions will occur as a consequence of measures to reduce car use and promote more extensive provision of public transport in the core-zone.

6 Conclusions

When current trends in transport are observed, it is clear that the system tends to move away from sustainable criteria, despite official policies which aim at achieving sustainability in the transport system. In this respect the question arises to which extent the distinct objectives are feasible and whether these can be achieved at the same time. In this paper this is analysed for the Common Transport Policy (CTP) of the EU. First, indicators have been identified for the CTP objectives of efficiency, regional development and environment. Literature on environmental indicators is fairly extensive and comprehensive and a range of indicators for this objective are in use. Literature on indicators of regional development and efficiency on the other hand, are much less extensive or comprehensive, however some indicators have been identified.

After the definition of main indicators, some interesting conclusions can be drawn from our scenario experiment. A first striking result is, that the cooperation framework may result in a worse starting point for the achievement of sustainability criteria than the polarisation framework, because of higher mobility levels due to the higher economic growth. The only field where this may not hold is for regional development; in a polarisation framework these objectives may be harder to achieve, because of the lower European cohesion funds. It follows that the more efficient policy making due to cooperation should first compensate for the higher mobility rates.

Perhaps unsurprisingly, CO_2 emissions generally follow NO_x emissions in most scenarios. CO_2 and NO_x emissions will not reduce due to regional development policies. In Equitable Nations these also do not rise, because here mobility levels will not grow to a large extent; in the Equitable Europe scenario, the latter is the case, which results in increasing emissions.

Government subsidies to the transport sector are largely reduced in the efficiency scenarios, while in the other scenarios there is a less clear picture. Striking is that also public investments are reduced in the efficiency scenarios; apparently, these are not contributing to the efficiency of the transport sector and reductions in subsidies may not be achieved at the same time as reductions in infrastructure expenditure. On the other hand, investments may contribute to environmental objectives when public transport infrastructure is constructed.

When the focus of the CTP is put on the three dimensions, little impact can be expected on safety issues. Additional policies to achieve this target are necessary, which may be part of each of the six scenarios. Especially within the Polarisation framework, these policies are likely to be introduced at the national level.

Within the Cooperation framework, the EU may set safety and technological standards.

The last issue relates to congestion. In an efficiency scenario these problems may be solved largely, due to price increases and intemalization of external costs. The same may hold for environmental objectives. Regional development objectives however, may negatively impact congestion rates.

In order to keep the analysis manageable, impacts on socially weak groups have not been discussed at length in the scenarios. It should be acknowledged, however, that price measures and reductions of the public transport system may have negative impacts on these groups. In this respect, Polarisation may have more negative impacts than Cooperation, while especially the regional development scenarios (which also included social cohesion objectives) may have most positive impacts on socially weaker groups.

It seems that there is to a large extent complementarity between economic efficiency and environmental protection objectives in most scenarios (see Figure 4). There is little complementarity, however, between the achievement of regional development objectives and environmental or efficiency objectives. The assessments of the scenarios indicate that, in general, assuming one of the two external frameworks does not largely impact outcomes and comnlementarity.

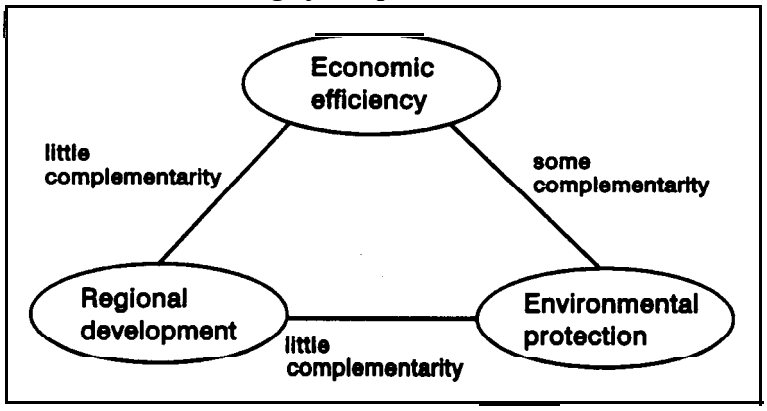

Figure 4 The complementarity of the distinct objectives

It can be concluded that the win-win-win strategy is not possible under any of the scenarios. However, a win-win strategy can be achieved if the economic efficiency policy objective is combined with an environmental protection policy.

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